Remarks

The final Office Action of 20 November 2002 and the Advisory Action of 11 February 2003 have been received and reviewed. In view of the Request for Continued Examination (RCE) filed on even date herewith, reconsideration and withdrawal of the rejections of claims 58-105, and entry and consideration of new claim 106, are respectfully requested for the reasons presented below.

The 35 U.S.C. §103 Rejections

Claims 58-80 and 83-105

Claims 58-80 and 83-105 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishioka et al. (U.S. Patent No. 5,489,548) in view of Summerfelt (U.S. Patent No. 6,117,689). Applicant traverses for at least the following reasons.

Independent claims 58, 66, 74, 83, 93, and 102 require, among other features, a substrate assembly having at least one metal-containing adhesion region and a surface region. After forming or otherwise depositing a conductive layer (e.g., platinum) on the substrate assembly, the substrate assembly is annealed, causing pooling of the conductive layer on the surface region of the substrate assembly. The conductive layer is then removed from the surface region (or other portion), leaving a patterned conductive layer.

"Pooling" is described in the specification at page 5, lines 25-29 as "a phenomenon that is believed to be similar to non-wetting of a surface wherein the binding energy of the material deposited (e.g., platinum, ruthenium) is much greater to itself that to the surface to which it is deposited (e.g., silicon, BPSG, etc.) so that "islands" of the deposited material form."

To establish *prima facie* obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the documents themselves or in the knowledge generally available to one of ordinary skill in the art, to combine document teachings. Second, there must be a reasonable expectation of success. Finally, the references, when combined, must teach or suggest all the claim limitations.

Nishioka et al. is directed to a method of forming hi-dielectric-constant material electrodes. In general, Nishioka et al. utilizes "a lower electrode comprising a sidewall spacer to form a top surface with rounded corners on which the HDC material can be deposited without substantial cracking, (col. 3, lines 46-49). An important aspect of Nishioka et al. is that "the sidewall spacer does not reduce the electrical contact surface area between the lower electrode and the HDC material layer as compared to a similar structure containing a lower electrode without a sidewall spacer," (col. 3, lines 49-54).

Summerfelt, on the other hand, is directed to a method of forming an oxygen-diffusion resistant electrode for high-dielectric-constant materials. More particularly, Summerfelt describes an integrated circuit having an array of microelectronic structures, with each of the microelectronic structures having an oxidizable layer, a barrier layer overlying the oxidizable layer, a single crystal oxygen stable layer overlying the barrier layer, and a high-dielectric-constant material layer overlying the oxygen stable layer, (*see e.g.*, col. 2, lines 42-47).

In the portions of Summerfelt relied upon by the Office Action, Summerfelt describes recessed TiN plugs on a substrate that provide preferential nucleation of platinum, thereby separating nucleation "on" the plug from that "off" the plug. After some platinum nuclei have nucleated on the substrate, the substrate may be annealed to promote Ostwald ripening. During annealing, small platinum nuclei become smaller and eventually disappear, while larger, more stable nuclei grow at the expense of the smaller nuclei. During this process, two small, closely spaced nuclei will rearrange such that only one platinum nucleus remains, (*see e.g.*, col. 7-8. The platinum will "nucleate preferentially in the plugs 74 and then establish a depletion zone around the plugs 74," (col. 7, lines 57-62).

The Office Action relies upon Summerfelt to teach the pooling aspects of the claimed invention. In Applicant's previous Response (dated 21 January 2003), Applicant submitted that pooling, as described and claimed by Applicant, was neither taught nor suggested by the nucleation technique of Summerfelt. In the Advisory Action of February 11, 2003, however, the

Examiner stated that during the Summerfelt process, "platinum nucleuses becomes smaller and eventually disappear while larger more stable nuclei grow at the expense of the smaller nuclei. Therefore, Summerfelt inherently teaches pooling of the platinum on an exposed region of the substrate assembly," (*Advisory Action*, page 2).

Applicant traverses this assertion. The pooling of platinum in Applicant's claimed invention is unique in that, for example, it more easily allows the claimed subsequent removal of the platinum, e.g., by rinsing, from the preselected exposed surfaces areas of the substrate. There is no teaching identified in Summerfelt that the desired single crystal Ostwald ripening growth technique of its platinum layer is beneficial to subsequent removal, or to any purpose other than limiting oxygen diffusion.

In fact, Applicant asserts that the single crystal layer (i.e., the "pooled" platinum asserted by the Office Action) taught by Summerfelt actually teaches away from the claimed invention as the single crystal layer of Summerfelt is intended to be a permanent feature of the device (*see* Pt layer 98 in Figure 16e). In contrast, the pooled platinum of the claimed invention is subsequently removed from the selected regions of the substrate. Stated another way, Applicant submits that Summerfelt does not teach or suggest the claimed pooling, i.e., it does not suggest a deposition technique wherein the binding energy of the material deposited is much greater to itself than to the surface to which it is deposited so that 'islands' of the deposited material form. "A prior art reference must be considered in its entirety, i.e., as a whole, including portions that would lead away from the claimed invention." *M.P.E.P.* § 2141.03, citing *W.L. Gore & Associates, Inc. v. Garlock, Inc.*, 721 F.2d 1540, 220 USPQ 303 (Fed. Cir. 1983), cert. denied, 469 U.S. 851 (1984).

Moreover, Applicant submits that there is no suggestion or motivation identified to combine the teachings of Summerfelt with those of Nishioka et al. For instance, contrary to the assertions of the Office Action, Applicant submits that Summerfelt does not teach or suggest nucleation of platinum "only on areas where the adhesion layer is located," (*Id.* at page 3). Rather, as the figures of Summerfelt clearly show, nucleation sites exist both on the TiN plugs

64 (see Pt nuclei 70) and on the SiO_2 layer 34 (see Pt nuclei 72 in Figs. 9 and 10). Accordingly, there is no suggestion that Summerfelt, when combined with Nishioka et al., would produce nucleation only at selected adhesion layer sites.

For at least these reasons, Applicant submits that claims 58-80 and 83-105 are patentable over Nishioka et al. in view of Summerfelt. Reconsideration and withdrawal of the rejection are therefore requested.

Claims 81 and 82

Claims 81 and 82 were rejected under 35 U.S.C. § 103(a) as being unpatentable over Nishioka et al. in view of Summerfelt as applied to claims 58-80 and 83-105, and further in view of DeOrnellas et al. (U.S. Patent No. 6,127,277). Applicant traverses.

As claims 81 and 82 depend from claim 74, each includes the limitations contained therein. As a result, Applicant submits that Nishioka et al. in view of Summerfelt fails to teach each and every element of the claimed invention, e.g., fails to teach pooling of the conductive metal layer. Nothing is identified in DeOrnellas et al. that remedies this deficiency.

Applicant further notes, contrary to the Office Action, that DeOrnellas et al. does not teach or suggest "removing unadhered platinum" by "rinsing the substrate assembly in a rinsing composition" as claimed. Rather, the identified portions of DeOrnellas et al. describe a "second step" that "is effective in etching away the veils while maintaining the sidewall profile so that a semiconductor feature such as shown in FIGS. 7 and 10 is established. . . Preferably, subsequent to the chemical etch operation, the semiconductor wafer is rinsed prior to a photoresist stripping operation so that water soluble compounds such as water soluble chlorides can be washed away prior to the photoresist stripping or ash operation," (col 5, lines 29-44). However, there is no indication identified that platinum is removed by the rinsing step.

For at least these reasons, Applicant submits that claims 81 and 82 are not obvious in view of the cited references. Reconsideration and withdrawal of the rejection are therefore respectfully requested.

New Claim

Applicant requests entry and consideration of new claim 106. This claim is similar in most respects to claims 58-105, and recites "annealing the substrate assembly including the conductive metal layer, whereby the conductive metal layer forms pools of conductive metal material on the surface region of the substrate assembly; and removing the pools of conductive metal material from the surface region by rinsing the substrate assembly in a rinsing composition."

For the reasons enumerated above, the combinations of Nishioka et al. and Summerfelt, and Nishioka et al., Summerfelt, and DeOrnellas fail to render this claim obvious.

Summary

It is submitted that pending claims 58-106 are in condition for allowance and notification to that effect is requested. The Examiner is invited to contact Applicant's Representatives, at the below-listed telephone number, if it is believed that prosecution of this application may be assisted thereby.

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